Federation of Malysia

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ASD 402 (2007) (English): Control Of Obstacle At Aerodrome

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AIRPORT STANDARDS DIRECTIVE 402
[ASD 402]

CONTROL OF OBSTACLES AT AERODROMES

AIRPORT STANDARDS DIVISION
DEPARTMENT OF CIVIL AVIATION MALAYSIA

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INTRODUCTION

1. All fixed and mobile objects, or parts thereof, that are located on an area intended for surface movement of aircraft or that extend above a defined surface intended to protect aircraft in flight, at an aerodrome, are obstacles.

2. However, certain airport equipments and installations, because of their air navigation functions, must inevitably be so located and/or constructed that they are obstacles.

3. In addition, vehicles and aircraft, generally termed as transient objects, due to operational requirements need to positioned close to the runway and other vehicle and servicing equipments on the movement area, are regarded as obstacles as well.

4. This Directive has been written in general terms. Specific advice could be obtained from the Authority at:

Department of Civil Aviation
Airport Standards Division
Level 1 Block Podium B 4G4 Precinct 4
No. 27 Persiaran Perdana
Federal Government Administration Centre
62618 Putrajaya.
Phone: 03-88714000
Fax : 03-88714335

OBJECTIVE

5. This Airport Standards Directive is intended to supplement ASD 401 : Control and Denoting Obstacles.

6. This Directive outlines the application of rules, instructions and practices pertaining to the restrictions of obstacles at aerodromes to which aerodrome operator shall be informed and oblige to comply.

OBSTACLES AT AERODROMES

7. Objects regarded as obstacles are as follows:

(i) Fixed objects, whether temporary or permanent, or parts thereof, that are located on an area intended for the surface movement of aircraft are obstacles.

(ii) Mobile objects, whether temporary or permanent, or parts thereof, that are located on an area intended for the surface movement of aircraft are obstacles.

(iii) Fixed objects, whether temporary or permanent, that are extended above defined surfaces intended to protect aircraft in flight are obstacles.

(iv) Fixed or mobile objects that penetrate the obstacle limitation surfaces are obstacles.

OBSTACLE RESTRICTION RULES

8. No fixed objects or mobile objects that may constitute as obstacles shall be permitted -

    (i) to be located and/or constructed

        a. on a runway strip;
        b. on a runway end safety area;
        c. on a taxiway strip;
        d. within a taxilane clearance distance;
        e. adjacent to aircraft stand; and
        f. on a clearway.

    (ii) to be located and/or constructed within

        a. ILS Localizer critical areas; and
        b. ILS Glide Path sensitive and critical areas

    (iii) to be extended into the Obstacle Protection Surfaces;

    (iv) to be extended into the Obstacle Free Zone; and

    (v) to be extended above the Obstacle Limitation Surface.

    - except when, such fixed objects or mobile objects satisfies conditions specified under the following paragraphs.

OBSTACLES ON RUNWAY STRIPS

9. No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be located and/or constructed on a runway strip, other than equipment and installations required for air navigation purposes and shall be frangible and mounted as low as possible.

10. Fixed objects or mobile objects satisfying conditions specified above, shall be restricted as follows –

    (i) Zone I :
    Only visual aids required for air navigation purposes, except wind direction indicator, are allowed in areas defined within -

        a. 77.5 m of the runway centre line where the code number is 4 and the code letter is F; or

        b. 60 m of the runway centre line where the code number is 3 or 4; or

        c. 45 m of the runway centre line where the code number is 1 or 2.

(ii) Zone II :
Other navigational aids, including wind direction indicator, are allowed in areas beyond -

a. 77.5 m of the runway centre line where the code number is 4 and the code letter is F; or

b. 60 m of the runway centre line where the code number is 3 or 4; or

c. 45 m of the runway centre line where the code number is 1 or 2.

(iii) Zone III :
Any other objects, including supporting equipment and installations for navigational aids, shall be located outside runway strips.

OBSTACLES ON RUNWAY END SAFETY AREA [RESA]

11. No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be located and/or constructed on a RESA, other than equipment and installations required for air navigation purposes and shall be frangible and mounted as low as possible.

12. Fixed objects or mobile objects satisfying conditions specified above, shall be restricted as follows –

(i) For a precision approach runway category I, II and III :
Only aids required for air navigation purposes are allowed in areas within 240 m from the end of runway strip and within -

a. 60 m of the extended runway centre line where the code number is 3 or 4; or

b. 45 m of the extended runway centre line where the code number is 1 or 2.

(ii) For a non-precision approach runway :
Only aids required for air navigation purposes are allowed on a runway end safety area.

(iii) For a non-instrument runway with code number 1 or 2, and where a runway end safety area is provided :
Only aids required for air navigation purposes are allowed on a runway end safety area.

(iv) Any other objects, including supporting equipment and installations for navigational aids, shall be located outside runway end safety areas.

OBSTACLES ON TAXIWAY STRIPS

13. No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be located and/or constructed on a taxiway strip, other than equipment and installations required for air navigation purposes and mounted as low as possible.

14. Other objects shall be restricted as follows –

Code Letter	Between taxiway centreline to object [metres]
A	16.25
B	21.5
C	26
D	40.5
E	47.5
F	57.5

OBSTACLES WITHIN TAXILANE CLEARANCE DISTANCE

15. No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be located and/or constructed within a taxilane clearance distance, other than equipment and installations required for air navigation purposes and other than equipment and installations required for air navigation purposes and mounted as low as possible.

16. Other objects shall be restricted as follows –

Code Letter	Between taxilane centreline to object [metres]
A	12
B	16.5
C	24.5
D	36
E	42.5
F	50.5

OBSTACLES IN PROXIMITY OF AIRCRAFT STANDS

17. No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be located and/or constructed adjacent to an aircraft stand provided that a minimum clearance is established between an aircraft using the stand and any obstacle, including buildings, vehicles and aircraft on another stand, as follows -

Code Letter	Clearance distance [metres]
A	3
B	3
C	4.5
D	7.5
E	7.5
F	7.5

18. To ensure the minimum clearance between an aircraft using the stand and objects on the apron, safety lines shall be provided so as to define areas intended for use by vehicles and other aircraft servicing facilities.

OBSTACLES ON CLEARWAY

19. No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be located and/or constructed on a clearway, other than equipment and installations required for air navigation purposes and shall be frangible and mounted as low as possible.

20. Not withstanding the above, a clearway shall end at the first upstanding obstacle.

OBSTACLES ON LOCALIZER CRITICAL / SENSITIVE AREAS

21. No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be located and/or constructed on the ILS localizer critical and sensitive areas.

22. The localizer critical area is defined as –

    (i) an area of 75 m radius behind the localizer antenna; and

    (ii) a rectangular area with a width of 60 m on either side of the antenna and extending to at least 300 m forward from the antenna or the near runway end, whichever is nearer.

23. The localizer sensitive area is defined as –

		Localizer antenna aperture	
ILS Category	Sensitive area	Typical 27 m directional dual freq. 14 elements	Typical 16 m semi-directional dual freq. 8 elements
I	X Y	600 m 60 m	600 m 110 m
II	X Y	1220 m 90 m	2750 m 210 m
III	X Y	2750 m 90 m	2750 m 210 m

OBSTACLES ON GLIDE PATH CRITICAL / SENSITIVE AREAS

24. No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be located and/or constructed on the ILS glide path critical and sensitive areas.

25. The glide path critical area is defined as –

    (i) an area of 100 m radius behind the glide path antenna; and

    (ii) a rectangular area extending to at least 250 m forward from the antenna with a width being the distance between the antenna and the runway edge and extending to at least 30 m to the other side of the antenna.

26. The glide path sensitive area is defined as –

ILS Category	Sensitive area	Length
I	X Y	915 m 60 m
II	X Y	975 m 90 m
III	X Y	975 m 90 m

OBSTACLES WITHIN OBSTACLE PROTECTION SURFACE

27. No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be extended into the obstacle protection surface.

28. The dimensions and slopes of the obstacle protection surface shall be as follows -

	Runway type / code number							
	Non-instrument code number				Instrument code number			
	1	2	3	4	1	2	3	4
Surface dimension								
Length of inner edge	60 m	80 m❶	150 m	150 m	150 m	150 m	300 m	300 m
Distance from threshold	30 m	60 m	60 m	60 m	60 m	60 m	60 m	60 m
Divergence [each side]	10 %	10 %	10 %	10 %	15 %	15 %	15 %	15 %
Total length	7500 m	7500 m❷	15000 m	15000 m	7500 m	7500 m❷	15000 m	15000 m
Slope								
T-VASIS and AT-VASIS	-❸	1.9º	1.9º	1.9º	-	1.9º	1.9º	1.9º
PAPI ❹	-	A -0.57º	A -0.57º	A -0.57º	A -0.57º	A -0.57º	A -0.57º	A -0.57º
APAPI ❹	A -0.9º	A -0.9º	-	-	A -0.9º	A -0.9º	-	-

❶ The length is to be increased to 150 m for T-VASIS or AT-VASIS
❷ The length is to be increased to 15000 m for T-VASIS or AT-VASIS
❸ No slope has been specified if a system is unlikely to be used on runway type / code number indicated.
❹ Angles are angles specified for setting angles A.

OBSTACLES WITHIN OBSTACLE FREE ZONE

29. No fixed objects that may constitute as obstacles shall be permitted to be extended into the obstacle free zone, except visual aids required for air navigation purposes and shall be frangible and mounted as low as possible.

30. Mobile objects shall not be permitted to be in the obstacle free zone during the use of runway for landing.

31. The obstacle free zone is the airspace defined by -

31.1 Inner approach surface

Description
A rectangular portion of the approach surface immediately preceding the threshold.

Characteristics
The limits of the inner approach surface shall comprise -

(a) an inner edge coincident with the location of inner edge of the approach surface but of its own specified length;
(b) two sides originating at the ends of the inner edge and extending parallel to the vertical plane containing the centreline of the runway; and
(c) an outer edge parallel to the inner edge.

The slopes and dimension of the inner approach surface shall be as follows –

	Precision category I Code number		Precision catehory II or III Code number
	1,2	3,4	3,4
Width	90m	120m*	120m*
Distance from threshold	60m	60m	60m
Length	900m	900m	900m
Slope	2.5%	2%	2%

* where code letter is F, the width shall be increased to 155 m

31.2 Inner transitional surface

Description
A surface similar to the transitional surface but closer to the runway.

Characteristics
The limits of an inner transitional surface shall comprise -

(a) a lower edge beginning at the end of the inner approach surface and extending down to the side of the inner approach surface to the inner edge of the surface, from there along the strip parallel to the runway centreline to the inner edge of the balked landing surface and from there up the side of the balked landing surface to the point where the side intersects the inner horizontal surface; and
(b) an upper edge located in the plane of the inner horizontal surface.

The elevation of a point on the lower edge shall be –

(a) along the side of the inner approach surface and balked landing surface – equal to the elevation of the particular surface at that point; and
(b) along the strip – equal to the elevation of the nearest point on the centreline of the runway or its extension.

The slopes of the inner transitional surface shall be as follows –

	Precision category I Code number		Precision catehory II or III Code number
	1,2	3,4	3,4
Slope	40%	33.3%	33.3%

31.3 Balked landing surface

Description
An inclined plane located at a specified distance after the threshold, extending between the inner transitional surface.

Characteristics
The limits of the balked landing surface shall comprise -

(a) an inner edge horizontal and perpendicular to the centreline of the runway and located at a specified distance after the threshold;
(b) two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the vertical plane containing the centreline of the runway; and
(c) an outer edge parallel to the inner edge and located in the plane of the inner horizontal.

The elevation of the inner edge shall be equal to the elevation of the runway centreline at the location of the inner edge.

The slope of the balked landing surface shall be measured in a vertical plane at right angles to the centreline of the runway.

The slopes and dimension of the balked landing surface shall be as follows –

	Precision category I Code number		Precision catehory II or III Code number
	1,2	3,4	3,4
Length of inner edge	90m	120m*	120m*
Distance from threshold	**	1 800m	1 800m
Divergence [each side]	10%	10%	10%
Slope	4%	3.33%	3.33%

* where code letter is F, the width shall be increased to 155 m
** distance to the end of strip

OBSTACLES WITHIN OBSTACLE LIMITATION SURFACES

32. No fixed objects or mobile objects that may constitute as obstacles shall be permitted to be extended into the obstacle limitation surfaces, except when, in the opinion of the Department of Civil Aviation –

    (a) the obstacle would be shielded by an existing immovable object; or

    (b) following an aeronautical study that the object would not adversely affect the safety or significantly affect the regularity of operations of aircraft.

33. The obstacle limitation surfaces at and in vicinity of an aerodrome are –

    33.1 Approach surface

    Description
    An inclined plane or combination of planes preceding the threshold.

    Characteristics
    The limits of the approach surface shall comprise -
    (a) an inner edge of specified length, horizontal and perpendicular to the extended centreline of the runway and located at a specified distance from the threshold;
    (b) two sides originating at the ends of the inner edge and diverging at a specified rate from the extended centreline of the runway; and
    (c) an outer edge parallel to the inner edge.

    The elevation of the inner edge shall be equal to the elevation of the mid-point of the threshold.

    The slope(s) of the approach surface shall be measured in the vertical plane containing the centreline of the runway.

    33.2 Transitional surface

    Description
    An complex surface along the side of the strip and part of the side of the approach surface, that slope upwards and outwards to the inner horizontal.

    Characteristics
    The limits of the transitional surface shall comprise -
    (a) a lower edge beginning at the intersection of the side of the approach surface with the inner horizontal surface and extending down the side of the approach surface to the inner edge of the approach surface and from there along the length of the strip parallel to the runway centreline; and
    (b) an upper edge located in the plane of the inner horizontal surface.

    The elevation of a point on the lower edge shall be –
    (a) along the side of the approach surface – equal to the elevation of the approach surface at that point; and
    (b) along the strip – equal to the elevation of the nearest point on the centreline of the runway or its extension.

    The slope of the transitional surface shall be measured in a vertical plane at right angles to the centreline of the runway.

33.3 Inner horizontal surface

Description
A surface located in a horizontal plane above an aerodrome and its environs.

Characteristics
The radius or outer limits of the inner horizontal surface shall be measured from the aerodrome reference point, for a single circular surface, or the thresholds of the runway, for racetrack surface. The shape of the inner horizontal surface, therefore, need not necessarily be circular.

The height of the inner horizontal surface shall be measured above the lowest runway threshold elevation.

33.4 Take-off climb surface

Description
An inclined plane or other specified surface beyond the end of a runway or clearway.

Characteristics
The limits of the take-off climb surface shall comprise -

(a) an inner edge horizontal and perpendicular to the centreline of the runway and located either at a specified distance beyond the end of the runway or at the end of the clearway when such is provided and its length exceeds the specified distance;
(b) two sides originating at the ends of the inner edge and diverging uniformly at a specified rate from the take-off track to a specified final width and continuing thereafter at that width for the remainder of the length of the take-off climb surface; and
(c) an outer edge horizontal and perpendicular to the specified take-off track.

The elevation of the inner edge shall be equal to the highest point on the extended runway centreline between the end of the runway and the inner edge, except when a clearway is provided the elevation shall be equal to the highest point on the ground on the centreline of the clearway.

In the case of a straight take-off path, the slope of the take-off climb surface shall be measured in the vertical plane containing the centreline of the runway.

In the case of a take-off flight path involving a turn, the take-off climb surface shall be a complex surface containing the horizontal normals to its centreline, and the slope of the centreline shall be the same as that for a straight take-off flight path.

34. The slopes and dimensions of the obstacle limitation surfaces are as described in Appendix A.

FRANGIBILITY

35. The frangibility of an object is its ability to retain its structural integrity and stiffness up to a desired maximum load, but on impact from greater load, to break, distort or yield in such a manner as to present minimum hazard to aircraft.

36. The frangibility characteristics should be proven either by means of full-scale tests or by computer evaluation using appropriate software code for structural analysis.

37. Elevated runway edge, threshold, end, stopway and taxiway edge

    37.1 These lights should be capable of withstanding –

        (a) where the runway code number is 3 and 4 or code letter C, D or E, a blast effect of 300 kt.

        (b) where the runway code number is 1 and 2 or code letter A or B, a blast effect of 200 kt.

    37.2 These should be mounted on frangible mounting devices. The impact load required to cause failure at the break point should not exceed 5 kg.m and a static load to cause failure should not exceed 230 kg applied horizontally 30 cm above the break point of the mounting device.

38. Approach lights

    38.1 These lights should be capable of withstanding –

        (a) for lights within 90 m of the runway threshold, 200 kt. blast effect.

        (b) for lights further out, 100 kt. blast effect.

    38.2 These lights and their supporting structure shall be frangible except that, in the portion of the approach lighting system beyond 300 m from threshold –

        (a) where the height of the supporting structure exceeds 12 m, the frangibility requirement shall apply to the top 12 m only; and

        (b) where a supporting structure is surrounded by non-frangible objects, only that part of the structure that extends above the surrounding object shall be frangible.

    38.3 The impact load required to cause failure of the unit and support should not exceed 5 kg.m and a static load to cause failure should not exceed 230 kg. applied horizontally 30 cm above the break point of the structure.

    38.4 The structure shall not wrap around the aircraft but shall crumble or collapse on impact.

39. Other visual aids

39.1 PAPI, T-VASIS, signs and markers shall be of low mass.

39.2 These aids shall be able to retain their structural integrity when subjected to the most severe environmental conditions. However, when subjected to aircraft impact in excess of the foregoing conditions, the aids will break or distort in a manner which will cause minimum or no damage to aircraft.

39.3 The light support base for these aids should not protrude above the ground but rather terminates below ground so as to cause minimum or no damage to aircraft overrunning them. However, the frangible coupling should be always above ground level.

HEIGHT LIMITATIONS

40. Elevated runway edge, threshold, end, stopway and taxiway edge

40.1 The desirable maximum height of light units and frangible coupling is 36 cm above ground.

40.2 Light units exceeding 36 cm above ground will require higher breaking characteristics for the frangible mounting.

41. Approach lights

41.1 Where approach lights are installed on displaced threshold of a runway or a stopway, the lights should be inset.

41.2 Otherwise, elevated approach lights should meet the criteria for frangibility agreed for lights installed beyond the runway end.

42. Other visual aids

42.1 PAPI, T-VASIS, signs and markers should be located as far as practicable from the edges of runway, taxiway and apron as is compatible with their functions.

SHIELDING

43. Shielding principles are employed when some permanent object, an existing building or terrain, already penetrate above one of the obstacle limitation surface. Then additional objects within a specified area around it may be permitted to penetrate the surface without being considered as obstacles.

44. Shielding shall be based on a horizontal plane projected from the top of the obstacle away from the runway and a plane with a negative slope of 10% towards the runway. Any objects below either the two planes would be considered shielded.

45. The permission to allow objects to penetrate an obstacle limitation surface under the shielding principle shall, however, be qualified by reference to the need of an aeronautical study in all cases.

AERONAUTICAL STUDY

46. An aeronautical study may be conducted to assess the impact of deviations from standards pertaining to obstacle limitation surfaces and to present alternatives means of ensuring safety to aircraft operations, to estimate the effectiveness of the alternatives and to recommend procedures to compensate for the deviation.

47. The aeronautical study shall provide justification for the deviation on grounds that an equivalent level of safety can be attained by other means. This is generally applicable when the cost of correcting for compliance is excessive but where the unsafe effects can be overcome by some procedural means.

DEVIATIONS

48. The Department of Civil Aviation shall notify and publish deviations from any Standards and Recommended Practices contained in ICAO Annex 14 in the appropriate Aeronautical Information Services publications in compliance to the Article 38 of the Convention on International Civil Aviation.

49. The Appendices to this Directive shall be taken, construed, read and be part of this Directive.

AZHARUDDIN ABDUL RAHMAN
Director General
Department of Civil Aviation
Malaysia

Dated: 16 JULY 2007

APPENDIX A

DIMENSION AND SLOPES
OBSTACLE LIMITATION SURFACES

RUNWAY CLASSIFICATION

Surface and dimension❶	Non-instrument				Non-Precision			Precision		
								I		II or III
	Code number				*Code number*			*Code number*		*Code number*
	1	2	3	4	1,2	3	4	1,2	3,4	3,4
APPROACH										
Length of inner edge	60m	80m	150m	150m	150m	300m	300m	150m	300m	300m
Distance from threhold	30m	60m	60m	60m	60m	60m	60m	60m	60m	60m
Divergence (each side)	10%	10%	10%	10%	15%	15%	15%	15%	15%	15%
First section										
Length	1 600m	2 500m	3 000m	3 000m	2 500m	3 000m	3 000m	3 000m	3 000m	3 000m
Slope	5%	4%	3.33%	2.5%	3.33%	2%	2%	2.5%	2%	2%
Second section										
Length	-	-	-	-	-	3 600m❷	3 600m❷	3 600m❷	3 600m❷	3 600m❷
Slope	-	-	-	-	-	2.5%	2.5%	3%	2.5%	2.5%
Horizontal section										
Length	-	-	-	-	-	8 400m❷	8 400m❷	-	8 400m❷	8 400m❷
Total length	-	-	-	-	-	15 000m	15 000m	15 000m	15 000m	15 000m
TRANSITIONAL										
Slope	20%	20%	14.3%	14.3%	20%	14.3%	14.3%	14.3%	14.3%	14.3%
INNER HORIZONTAL										
Height	45m	45m	45m	45m	45m	45m	45m	45m	45m	45m
Radius	2 000m	2 500m	4 000m	4 000m	3 500m	4 000m	4 000m	3 5000m	4 000m	4 000m

RUNWAY CLASSIFICATION

Surface and dimension❶	*Code number* 1	*Code number* 2	3 or 4
TAKE-OFF CLIMB			
Length of inner edge	60m	80m	180m
Distance from runway end❸	30m	60m	60m
Divergence (each side)	19%	10%	12.5%
Final width	380m	580m	1 200m 1 800m❹
Length	1 600m	2 500m	15 000m
Slope	5%	4%	2%❺

❶ All dimension are measured horizontally unless specified otherwise
❷ The approach surface shall be horizontal beyond the point where slope intersects a horizontal plane 150 metres above threshold elevation or a horizontal plane passing through the top of any object that governs the OCA/H
❸ The take-off climb surface starts at the end of clearway if clearway length exceeds the specified distance
❹ 1800 metres when the intended track includes changes of heading greater than 15 degrees for operations conducted in IMC, VMC by night
❺ If no objects reaches 2% take-off climb surface, new object should be limited to preserve the existing obstacle free surface down to a slope of 1.6%.